REMARKS/ARGUMENTS

Favorable reconsideration and allowance of the present application are respectfully requested in view of the following remarks.

Claims 11-15, 25-28 and 30-47 remain pending, of which claims 11 and 12 are independent.

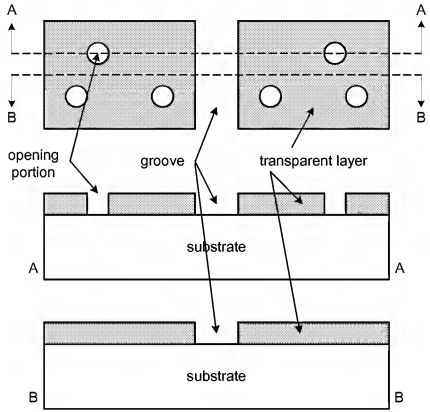
A. § 112, 1ST PARAGRAPH REJECTION

Claims 11-15, 25-28 and 30-47 stand rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. In particular, the Examiner alleges: (1) that the feature of "wherein the opening portion does not separate the transparent electrode layer" is not supported in the Original Disclosure, and (2) argues that in Figure 1 of the Original Disclosure shows the transparent electrode being separated by the opening portion. Applicants respectfully disagree. *Office Action, pp.2-3, item 2.*

Regarding (1), the Examiner's attention is respectfully directed to the Original Disclosure, section 1-3 beginning on *p.16, l.20.* This section is entitled "Opening portion of first transparent conductive layer". In this section, the Original Disclosure states:

> Herein, the above-mentioned opening portion does not include a groove for separating a transparent electrode provided for forming an integrated structure in which a plurality of photoelectric conversion cells are electrically connected in series on an insulating substrate, as described in a paragraph of Prior Art in Japanese Unexamined Patent Publication No. HEI 11 (1999)-186573. *Emphasis added; Original Disclosure, p.16, l.29 – p.17, l.5.*

Clearly, support for the recited feature is present in the Original Disclosure. For explanation, the following figure is presented. In the explanatory figure, upper part represents a top view of an example conversion device, middle part represent a side view of the device along a line A-A, and lower part represent a side view of the device along a line B-B.



The explanatory figure shows two transparent conductive layers – left and right. The circles in both the left and right transparent conductive layers represent opening portions. The line A-A' traverses an opening portion from both left and right transparent conductive layers. In the side view along the line A-A, it does indeed seem that there are four separate transparent conductive layers. But the top view makes clear that there are only two

transparent conductive layers, which are separated by a groove. In the side view along the line B-B which traverses no opening portions, only the groove truly separates the left transparent conductive layer from the right.

The Original Disclosure clearly differentiates between the opening portion which does not separate the transparent conductive layer and a groove which does separate one transparent conductive layer from another, i.e., support for the recited opening portion feature is clearly present.

Regarding (2), Figure 1 (*see right*) of the Original Disclosure is reproduced for convenience. Based on this figure alone, the Examiner

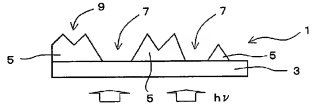


Figure 1 (Original Disclosure)

alleges that the transparent electrode (*transparent conductive layer 5*) is separated by holes (*opening portions 7*).

Note that Figure 1 is one view – a sectional view – of a photoelectric conversion device. *Original Disclosure, p.12, ll.3-4; p.47, ll.20-26.* Figure 1 is similar to the side view along the line A-A in the explanatory figure. From this perspective, it does indeed seem like that there are multiple transparent conductive layers 5 separated by the opening regions.

But as demonstrated above, one view does not tell the whole story. Applicants respectfully direct the Examiner's attention to Figures 17, 18 and

19 which illustrate plan views (top views) of example photoelectric conversion devices. Figure 18 (*see right*) is reproduced for illustration.[1] Figure 18 makes clear that the opening portions 272 do not separate the layer 282 in any way.

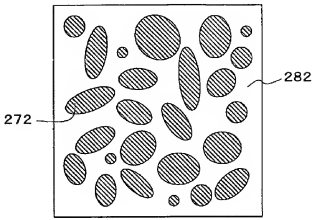


Figure 18 (Original Disclosure)

The Examiner defines the word "separate" to mean "to keep apart or divide as by intervening space" and applies the definition to Figure 1 to allege that the opening portions separate the transparent electrode. *Office Action, p.3, ll.2-3.* But as demonstrated, Figure 1 by itself is not the end-all-be-all. Figure 1 is one view. The plan views (*see e.g., Figure 18*) clearly show that the opening portions do not "keep apart or divide".

Applicants respectfully request that the rejections claims under §112, first paragraph be withdrawn.

B. § 112, 2ND PARAGRAPH REJECTION

Claims 11-15, 25-28 and 30-47 stand rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite. Applicants respectfully submit that the clarification provided above with respect to the §112, first paragraph rejection also addresses this §112, second paragraph issue.

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[1] Figures 17 and 19 could also be used for illustrative purposes.

Also, the Examiner, without any basis whatsoever, attempts to reinterpret the claim such that if a completely different layer can "fill in" the opening portions so as to maintain electrical connection, the feature "wherein the wherein the opening portion does not separate the first transparent electrode layer" will be considered satisfied.

This completely goes against the differentiation between an "opening portion" and a "groove" the Original Disclosure provides. For emphasis, the relevant portion of the Original Disclosure is again reproduced.

> Herein, the above-mentioned opening portion does not include a groove for separating a transparent electrode provided for forming an integrated structure in which a plurality of photoelectric conversion cells are electrically connected in series on an insulating substrate, as described in a paragraph of Prior Art in Japanese Unexamined Patent Publication No. HEI 11 (1999)-186573. *Emphasis added; Original Disclosure, p.16, l.29 – p.17, l.5.*

The groove separates one transparent electrode from another, but the opening portions do not. Top views of example devices illustrated in the Original Disclosure make this abundantly clear.

Applicants respectfully request that the rejections claims under §112, second paragraph be withdrawn.

C. § 102 REJECTION – KUWANO

Claims 11, 12, 25-27, 30, 36 and 44-46 stand rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Kuwano (U.S. Patent No. 4,281,208, *hereinafter Kuwano*). Applicants respectfully traverse.

A non-limiting aspect of the Original Disclosure is directed to a stacked photoelectric conversion device that can attain a high photocurrent and high photoelectric conversion efficiency. A superstrate type thin film solar cell includes a transparent conductive layer, a photoelectric conversion layer and a backside electrode layer stacked in this order on a transparent substrate. *Original Disclosure, p.1, l.9 – p.2, l.13.*

In a thin film solar cell, making effective use of light entering the semiconductor layer is important, which can be achieved through optical confinement. To improve optical confinement, the transparent layer should have high transmittance and should effectively scatter or refract incident light. Haze index is an evaluation characteristic to measure the scattering/refracting capability (higher index indicates higher capability). Haze index can be increased by having a surface texture in which level differences between projections and depressions of the texture is large. In addition, electrical sheet resistance should be minimized. *Original Disclosure, p.2, l.14 – p.3, l.19.*

Conventional solar cells are unable to achieve both high transmittance and high haze index simultaneously. High transmittance can be achieved by reducing the thickness of the transparent conductive layer. But doing so leads to an increase in the sheet resistance, and thus to an increase in the series resistance loss. Therefore, the photoelectric conversion efficiency of a photoelectric conversion device decreases as the thickness of the transparent conductive layer decreases. Further, when the film thickness is reduced, haze

index is decreased since the level difference between projections and depressions in the texture is decreased. *Original Disclosure, p.6, ll.19-29.*

Conversely, high haze index can be achieved by increasing the thickness of the transparent conductive layer so that the level difference between the projections and depressions can be made large. But, the quantity of light absorbed in the transparent conductive layer increases when the thickness increases, and therefore the transmittance is reduced and the photoelectric conversion efficiency is again decreased. *Original Disclosure, p.7, ll.1-7.*

Figure 3 (*see right*) of the Original Disclosure illustrates a sectional view of an example inventive photoelectric conversion device that address one or more problems associated with the conventional device. As seen, the example device

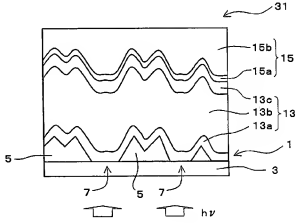


Figure 3 (Original Disclosure)

31 comprises, stacked in order, a transparent substrate 3, a transparent conductive layer 5, a photoelectric conversion layer 13 and a backside electrode layer 15. The conversion layer 13 comprises, stacked in order, a p-type semiconductor layer 13a, an i-type semiconductor layer 13b and an n-type semiconductor layer 13c. The backside electrode layer 15 comprises, stacked in order, a backside transparent conductive layer 15a and a conductive layer 15b. *Original Disclosure, p.49, ll.18-26.*

Independent claim 11 recites, in part, "a transparent electrode layer formed on at least a part of a surface region of the substrate, the transparent electrode layer having at least an opening portion within which the transparent electrode layer is absent." In Figure 3, the transparent conductive layer 5, the transparent substrate 3 and the opening portions 7 respectively correspond to the claimed transparent electrode layer, the substrate and the opening portion.

The correspondence is more clear in Figure 1 (*see right*) which illustrates a combination structure of the transparent substrate 3 and the transparent conductive layer 5. As seen, the transparent conductive layer 5 is formed on at least a part of the surface region of the transparent substrate 3. The transparent conductive layer 5 has at least an opening portion 7 that exposes the transparent substrate 3. The transparent conductive layer 5 also has a texture structure 9 on its surface. *Original Disclosure, p.47, ll.19-25.*

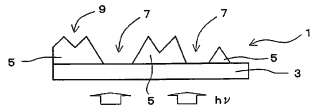


Figure 1 (Original Disclosure)

As demonstrated (*see Section A above*), Original Disclosure makes clear that the opening portion does not include a groove for separating a transparent electrode provided for forming an integrated structure in which a plurality of photoelectric conversion cells are electrically connected in series on an insulating substrate. *Original Disclosure, p.16, l.20 – p.17, l.11.* This is reflected in claim 11 which also recites, in part "wherein the opening portion does not separate the first transparent electrode layer."

In the Office Action, referring to Figures 4, 5 and 6 of Kuwano, the Examiner alleges that the transparent electrodes 91, 92 and 93 are equivalent to the claimed transparent conductive layer. For convenience, Figures 4 and 5 of Kuwano are reproduced (*see right*). Figure 5 shows the amorphous silicon layer 10 being composed of p-type layer 13, intrinsic layer 14 and n-type layer 15. The Examiner equates the regions between the individual transparent electrodes 91, 92 and 93 as being equivalent to the claimed opening regions. Then

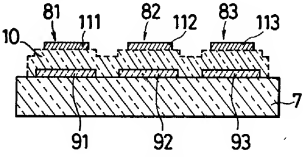


Figure 4 (Kuwano)

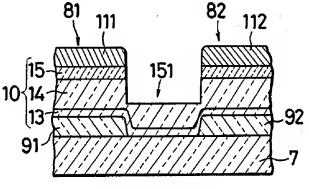


Figure 2 (Kuwano)

referring to Figure 5, the Examiner alleges that the electrodes 91 and 92 are electrically connected by the p layer 13, i.e., the electrodes are not separated. *Office Action, p.4, item 6.*

As demonstrated in *Section B*, above, the Examiner's interpretation of what constitutes an opening region is without any basis, and is completely contrary to the differentiation between grooves and opening regions clearly expressed in the Original Disclosure.

Contrary to the Examiner's wishes, the regions between the electrodes 91, 92 and 93 are grooves. This is better illustrated in Figure 2 of Kuwano

showing a plan view of the same photovoltaic device (*see right*). As seen, there are multiple photoelectric converting regions 81, 82 and 83, each comprising transparent electrodes 91, 92 and 93 formed on a substrate 7 spaced apart a predetermined distance. Second

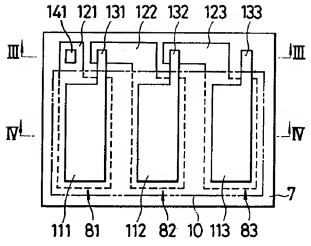


Figure 2 (Kuwano)

electrodes 111, 112 and 113 are formed on the amorphous silicon layer 10 above the corresponding photoelectric converting regions 81, 82 and 83, respectively. The respective transparent electrodes 91, 92 and 93 each face the corresponding second electrodes 111, 112 and 113. *Kuwano, c.4, ll.26-50.*

In Kuwano, both the sectional views (Figure 4, 5, 6) and the top view (Figure 2) show that the transparent electrodes 91, 92 and 93 are all separated by grooves. *See also Kuwano, Figure 7B.* There are no opening portions as recited in any of the individual transparent electrodes 91, 92 or 93. This is sufficient to distinguish claim 11 from Kuwano.

Independent claim 12 recites, in part "wherein the opening portion does not separate the first transparent electrode layer." As discussed above, Kuwano does not teach or suggest this feature. This is sufficient to distinguish claim 12 from Kuwano.

But in addition, claim 12 also recites, in part "a first photoelectric conversion layer stacked above a structure", "a first intermediate layer stacked above the first photoelectric conversion layer," and "a second photoelectric conversion layer stacked above the first intermediate layer such that the first intermediate layer is sandwiched between the first and second photoelectric conversion layers." In other words, claim 12 requires at least two photoelectric conversion layers with an intermediate layer sandwiched therebetween.

Figure 7 of the Original Disclosure (*see right*) illustrates an example device with multiple photoelectric conversion layers. The

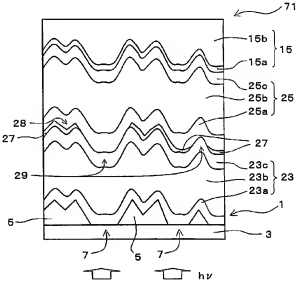


Figure 5 (Original Disclosure)

stacked photoelectric conversion device 71 comprises a first photoelectric conversion layer 23, a second photoelectric conversion layer 25, and a backside electrode layer 15 stacked in order on the substrate 1. The first intermediate layer 27 is formed in between the first and second photoelectric conversion layers 23, 25. The first conversion layer 23 comprises a p-type semiconductor layer 23a, an i-type semiconductor layer 23b, and an n-type semiconductor layer 23c. The second conversion layer 25 similarly comprises p-, i- and n-layers 25a, 25b, and 25c. *Original Disclosure, p.53, l.26 – p.54, l.29.*

Kuwano does not teach or suggest these features. Referring to Figure 5 of Kuwano, the Examiner alleges that the individual layers of the amorphous layer 10 – the p layer 13, the i layer 14, and the n layer 15 – are respectively equivalent to the claimed first photoelectric conversion layer, the first intermediate layer, and the second photoelectric conversion layer. *Office Action, p.5.* Such interpretation is unreasonable.

Applicants recognize that the claims are to be given their broadest reasonable interpretation. However, it is also well-established that the broadest reasonable interpretation of the claims must be consistent with the interpretation that those skilled in the art would reach. *MPEP 2111.* The words of a claim must be given their plain meaning, where plain meaning refers to the ordinary and customary meaning given to the term by those of ordinary skilled in the art. *MPEP 2111.01.*

In this instance, one of ordinary skill would realize that photoelectric conversion occurs due to a combination of p-i-n layers. Thus, one of ordinary skill would consider the entirety of the p-i-n layers 13, 14, 15 to make up a single photoelectric conversion layer. In Figure 7 of the Original Disclosure, note that both the first and second conversion layers 23, 25 each comprises a combination of p-i-n layers.

One or ordinary skill in the art would not interpret the p layer 13 and the n layer 15 of the amorphous layer 10 of Kuwano to be two different photoelectric conversion layers as the Examiner has done. The Examiner's

interpretation is inconsistent with the ordinary and customary meaning of "photoelectric conversion layer" that would be given by those of ordinary skill in the art. The Examiner's interpretation is unreasonable.

At least for the above stated reasons, claim 12 is distinguishable over Kuwano.

Claims 25-27, 30, 36 and 44-46 are distinguishable over Kuwano by virtue of their dependencies from independent claims 11 and 12 as well as on their own merits.

Applicants respectfully request that the §102 rejection based on Kuwano be withdrawn.

D. § 102 REJECTION – SATO

Claims 11, 12, 25-27, 30, 31, 35, 36 and 44-46 stand rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Sato (EP 1443527, *hereinafter Sato*). Applicants respectfully traverse.

Contrary to the Examiner's allegation, Sato does not teach or suggest all features recited in claim 11. The Examiner relies upon Figures 1 and 5 of Sato

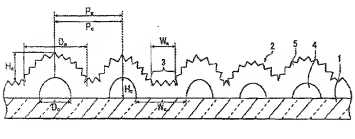


Figure 1 (Sato)

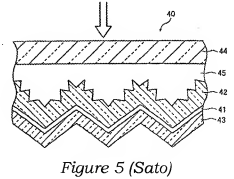


Figure 5 (Sato)

to allegedly disclose the features of claim 11. *Office Action, pp.7-8, item 7.* These figures are reproduced above for convenience.

Figure 1 illustrates a substrate 1 and a transparent conductive oxide (TCO) film. *Sato, [0018].* The substrate 1 is covered by discontinuous small ridges 4 made of a first oxide, and a continuous layer 5 made of a second oxide formed thereon. *Sato, [0033]-[0035].* In Figure 5, the solar cell 40 comprises a glass substrate 44, TCO film 45, a photoelectric conversion layer 42 made of a p-i-n layer of amorphous silicon, and a rear face electrode 43.

Regarding Figure 5, the TCO film 45 (alleged to be equivalent to the claimed transparent electrode layer) has no openings or grooves whatsoever. Thus, the embodiment of Figure 5 cannot in anyway disclose the claimed opening portion feature. It then logically follows that Figure 5 cannot disclose the feature of "wherein the opening portion is not covered by the transparent electrode layer" recited in claim 11.

Figure 1 is no better. The Examiner writes "A transparent electrode layer (45 and 4/5 of Figure 1) ..." *Office Action, p.7, last bullet.* The Examiner apparently considers the combination of the discontinuous small ridges 4 and the continuous layer 5 as being equivalent to the claimed transparent electrode layer. If the Examiner consider the combination of 4/5 as being equivalent, then this is exactly the same situation as Figure 5, i.e., the figure cannot disclose the claimed opening portion.

On the other hand, the Examiner could be alleging that either the small ridges 4 or the continuous layer 5 each on its own is equivalent. These interpretations also fail. First, Sato expressly indicates that the small ridges 4 are discontinuous. *Sato, [0035].* As such, the feature of "wherein the opening portion does not separate the transparent electrode layer" cannot be shown by the ridges 4 on their own.

The Examiner may be alleging that ridges 4 are equivalent to the claimed transparent electrodes and that the ridges are electrically connected by the continuous layer 5 to allege that the ridges 4 are not electrically separated. This again would constitute a complete ignoring of the clear differentiation between openings and grooves expressed in the Original Disclosure.

The continuous layer 5 by itself also cannot disclose the features of claim 11. Note that if the continuous layer 5 is taken to be equivalent to the claimed transparent electrode layer, then the claimed opening portions must correspond to the regions occupied by the small ridges 4. However, it is clear that the continuous layer 5 completely covers the small ridges 4. This is in complete contrast to the feature of "wherein the opening portion is not covered by the transparent electrode layer."

It is seen that no matter the interpretation, Sato cannot disclose the features of claim 11. As such, claim 11 is distinguishable over Sato. Claim 12 recites ""wherein the opening portion is not covered by the first transparent electrode layer." Claim 12 is distinguishable over Sato for this reason alone.

But in addition, claim 12 recites first and second photoelectric conversion layers with a first intermediate layer sandwiched therebetween. The Examiner again attempts to unreasonably interpret that the individual p-i-n layers of Sato's photoelectric conversion layer 42 to be equivalent to the claimed features.

Indeed, Sato explicitly states "**a photoelectric conversion layer** 42 made of a p-i-n type layer of a-Si". *Emphasis added; Sato, [0079].* Thus, Sato itself directly contradicts the Examiner.

At least for the above stated reasons, claim 12 is distinguishable over Kuwano.

Claims 25-27, 30, 31, 35, 36 and 44-46 are distinguishable over Sato by virtue of their dependencies from independent claims 11 and 12 as well as on their own merits.

Applicants respectfully request that the §102 rejection based on Sato be withdrawn.

E. § 103 REJECTION – KUWANO, KONDO

Claim 47 stands rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Kuwano as applied to claim 25 above, and further in view of Kondo (U.S. Patent No. 6,469,242). Applicants respectfully traverse.

It is demonstrated that independent claim 11 is distinguishable over Kuwano. Kondo does not correct the deficiencies of Kuwano. Therefore, claim

11 is also distinguishable over the Kuwano-Kondo combination. By virtue of its dependency from claim 11 as well as on its own merits, claim 47 is also distinguishable over the Kuwano-Kondo combination.

Applicants respectfully request that the §103 rejection based on the Kuwano-Kondo combination be withdrawn.

F. § 103 REJECTION – SATO, KONDO

Claim 47 stands rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Sato as applied to claim 25 above, and further in view of Kondo. Applicants respectfully traverse.

It is demonstrated that independent claim 11 is distinguishable over Sato. Kondo does not correct the deficiencies of Sato. Therefore, claim 11 is also distinguishable over the Sato-Kondo combination. By virtue of its dependency from claim 11 as well as on its own merits, claim 47 is also distinguishable over the Sato-Kondo combination.

Applicants respectfully request that the §103 rejection based on the Sato-Kondo combination be withdrawn.

G. § 103 REJECTION – SUZUKI, SATO

Claims 11-15, 25 and 36-46 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Suzuki (U.S. Patent No. 5,350,459) in view of Sato. Applicants respectfully traverse.

The Examiner admits that Suzuki does not disclose the transparent electrode layer as recited in claim 1, but alleges that Suzuki's deficiency can be corrected through Sato. *Office Action, p.13, item 13.* But as demonstrated above, Sato is deficient. For at least this reason, independent claims 11 and 12 are distinguishable over Suzuki and Sato.

The Examiner also alleges that Suzuki teaches a plurality of conversion layers. In actuality, Suzuki teaches a single photoelectric conversion layer composed of first and second electron acceptor organic layers EAOL (I) and (II), and first and second electron donor organic layers EDOL (I), and (II). *Suzuki, column 6, lines 12-17; Figs. 1 and 2.* Suzuki is explicit that the electric charges "are generated at the interface between the second electron acceptor organic layer EAOL (II) and the first electron donor organic layer EDOL (I)." *Suzuki, column 6, lines 17-21.* Thai is, the entirety of the organic layers EAOL (I), EAOL (II), EDOL (I) and EDOL (II) form a single photovoltaic layer. This is no different than alleging individual p-i-n layers of a single conversion layer as being equivalent to the claimed multiple conversion layers. Suzuki is in complete contrast to claim 12 which recites first and second photoelectric conversion layers.

For at least the above stated reasons, claims 11 and 12 are distinguishable over the Suzuki-Sato combination. Claims 13-15, 25 and 36-46 are distinguishable over the Suzuki-Sato combination by virtue of their dependencies from independent claims.

The dependent claims are also distinguishable on their own merits. For example, claims 13 and 14 both recite "wherein the first intermediate layer has at least an opening portion within which the first intermediate layer is absent." The Examiner alleges that the pin holes described in column 6 and in column 40 are equivalent to the claimed opening portion of the first intermediate layer. As demonstrated above, the EAOL (II) layer is part of the single photoelectric conversion layer in Suzuki. Suzuki does not disclose any layers resembling the claimed intermediate layer.

For at least the reasons stated above, Applicants respectfully request that the §103 rejection based on the Suzuki-Sato combination be withdrawn.

H. § 103 REJECTION – SUZUKI, SATO, KONDO

Claim 47 stands rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Suzuki in view of Sato as applied to claim 25 above, and further in view of Kondo. Applicants respectfully traverse.

It is demonstrated that independent claim 11 is distinguishable over the Suzuki-Sato combination. Kondo does not correct the deficiencies of the Suzuki-Sato combination. Therefore, claim 11 is also distinguishable over the Suzuki-Sato-Kondo combination. By virtue of its dependency from claim 11 as well as on its own merits, claim 47 is also distinguishable over the Suzuki-Sato-Kondo combination.

Applicants respectfully request that the §103 rejection based on the Suzuki-Sato-Kondo combination be withdrawn.

I. § 103 REJECTION – SATO

Claims 28 and 32-34 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Sato as applied to claims 25 and 31 above. Applicants respectfully traverse.

It is demonstrated that independent claim 11 is distinguishable over Sato. By virtue of its dependencies from claim 11 as well as on their own merits, claims 28 and 32-34 are also distinguishable over Sato.

Applicants respectfully request that the §103 rejection based on Sato be withdrawn.

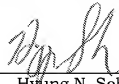
J. CONCLUSION

All objections and rejections raised in the Office Action having been addressed, it is respectfully submitted that the present application is in condition for allowance. Should there be any outstanding matters that need to be resolved, the Examiner is respectfully requested to contact Hyung Sohn (Reg. No. 44,346), to conduct an interview in an effort to expedite prosecution in connection with the present application.

The Commissioner is authorized to charge the undersigned's deposit account #14-1140 in whatever amount is necessary for entry of these papers and the continued pendency of the captioned application.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: 

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